CLAIMS:

1. An apparatus for carrying out identical continuous records of characteristics on the surface of an object after selected stages of manufacture and treatment of said objects comprising:

a rigid frame;

a rotary table rotatingly supported in said frame, said rotary table having means for centering said objects and having a center of rotation and a periphery;

rotary drive means installed on said rigid frame for rotating said rotary table;

guide means on said rigid frame located above said rotary table and extending in a direction across said rotary table;

a carriage moveable along said guide means and supporting a resonance sensor unit having a resonance sensor based on resonance sensor technology, said carriage having vertical adjustment means capable of adjusting a measurement distance between said resonance sensor and the surface of said object;

linear drive means for moving said carriage with said resonance sensor unit along said guide means, said apparatus having an initial position for starting said identical continuous records;

first positioning means for accurately positioning said rotary table angularly in said initial position;

second positioning means for accurately positioning said resonance sensor linearly in said initial position;

third positioning means for accurately positioning said object on said rotary table in said initial position; and

a central processing unit connected to said rotary drive means, said linear drive means, said positioning means, said second positioning means, and said third positioning means, said rotary movement of said rotary table and said linear

movement of said carriage being strictly correlated with each other through said central processing unit;

said object having a marking item.

2. The apparatus of Claim 1, wherein said first positioning means comprise: a flag portion attached to said rotary table for joint rotation therewith and a rotary table angular position sensing means installed on said rigid frame, said flag portion having a length, a leading edge on the front end of said length in the direction of said joint rotation and a trailing edge on the rear end of said length.

3. The apparatus of Claim 2, wherein said rotary table angular position sensing means comprises a light-emitting element that emits a light beam and a light-receiving element that is located at a space from said light-emitting element and senses said light beam, said flag portion passing through said space during said joint rotation of said flag portion so that said passage of said beam to said light-receiving element is interrupted.

4. The apparatus of Claim 3, wherein said light-emitting element is a laser diode and said light-receiving element is a photodiode.

5. The apparatus of Claim 4, wherein said second positioning means comprise a linear encoder having a reading head on one of said carriage and said rigid frame and a scale element on the other of said carriage and said frame.

6. The apparatus of Claim 1, wherein said second positioning means comprise a linear encoder having a reading head on one of said carriage and said rigid frame and a scale element on the other of said carriage and said frame.

7. The apparatus of Claim 6, wherein said first positioning means comprise: a

flag portion attached to said rotary table for joint rotation therewith and a rotary table angular position sensing means installed on said rigid frame, said flag portion having a length, a leading edge on the front end of said length in the direction of said joint rotation and a trailing edge on the rear end of said length.

8. The apparatus of Claim 7, wherein said rotary table angular position sensing means comprises a light-emitting element that emits a light beam and a light-receiving element that is located at a space from said light-emitting element and senses said light beam, said flag portion passing through said space during said joint rotation of said flag portion so that said passage of said beam to said light-receiving element is interrupted.

9. The apparatus of Claim 8, wherein said light-emitting element is a laser diode and said light-receiving element is a photodiode.

10. The apparatus of Claim 9, wherein said third positioning means comprise a plurality of clamping elements arranged circumferentially uniformly around said periphery of said object, at least one of said clamping elements engaging said marking item.

11. The apparatus of Claim 1, wherein said third positioning means comprise a plurality of clamping elements arranged circumferentially uniformly around said periphery of said object, at least one of said clamping elements engaging said marking item.

12. The apparatus of Claim 11, further provided with clamping pin moving means installed on said rigid frame and engaging said clamping pins for moving said clamping pins radially outwardly/ inwardly in order to provide unobstructed

access for said object to initial position on said rotary table and to clamp said object in said initial position, respectively.

13. The apparatus of Claim 12, wherein said object is a semiconductor wafer and said marking item is a V-shaped notch on a semiconductor wafer, said clamping pins being spring-loaded with springs so that when said clamping pin moving means engages said claming pins, said clamping pins move radially outwardly, and when said clamping pin moving means are out of engagement with said clamping pins, said springs move said clamping pins radially inwardly against said semiconductor wafer for clamping said semiconductor wafer.

14. The apparatus of Claim 13, wherein said third positioning means comprise a plurality of clamping elements arranged circumferentially uniformly around said periphery of said object, at least one of said clamping elements engaging said marking item.

15. The apparatus of Claim 2, wherein said third positioning means comprise a plurality of clamping elements arranged circumferentially uniformly around said periphery of said object, at least one of said clamping elements engaging said marking item.

16. The apparatus of Claim 15, further provided with clamping pin moving means installed on said rigid frame and engaging said clamping pins for moving said clamping pins radially outwardly/ inwardly in order to provide unobstructed access for said object to initial position on said rotary table and to clamp said object in said initial position, respectively.

17. The apparatus of Claim 16, wherein said object is a semiconductor wafer and said marking item is a V-shaped notch on a semiconductor wafer, said clamping

pins being spring-loaded with springs so that when said clamping pin moving means engages said claming pins, said clamping pins move radially outwardly, and when said clamping pin moving means are out of engagement with said clamping pins, said springs move said clamping pins radially inwardly against said semiconductor wafer for clamping said semiconductor wafer.

18. The apparatus of Claim 5, wherein said third positioning means comprise a plurality of clamping elements arranged circumferentially uniformly around said periphery of said object, at least one of said clamping elements engaging said marking item.

19. The apparatus of Claim 18, further provided with clamping pin moving means installed on said rigid frame and engaging said clamping pins for moving said clamping pins radially outwardly/ inwardly in order to provide unobstructed access for said object to initial position on said rotary table and to clamp said object in said initial position, respectively.

20. The apparatus of Claim 19, wherein said object is a semiconductor wafer and said marking item is a V-shaped notch on a semiconductor wafer, said clamping pins being spring-loaded with springs so that when said clamping pin moving means engages said claming pins, said clamping pins move radially outwardly, and when said clamping pin moving means are out of engagement with said clamping pins, said springs move said clamping pins radially inwardly against said semiconductor wafer for clamping said semiconductor wafer.

21. The apparatus of Claim 1, wherein said resonance sensor unit comprises:

a resonance oscillating circuit characterized by inherent inductance, inherent capacitance, and an inherent resonance frequency;

a high-frequency AC generator with an amplitude modulator connected to said sensor means;

an amplifier connected to said sensor means;

a measurement unit connected to said central processing unit;

said resonance oscillating circuit having such a relationship between said inherent inductance and inherent capacitance that provides a capacitive and inductive coupling between said sensor unit and said object.

22. The apparatus of Claim 2, wherein said resonance sensor unit comprises:

a resonance oscillating circuit characterized by inherent inductance, inherent capacitance, and an inherent resonance frequency;

a high-frequency AC generator with an amplitude modulator connected to said sensor means;

an amplifier connected to said sensor means;

a measurement unit connected to said central processing unit;

said resonance oscillating circuit having such a relationship between said inherent inductance and inherent capacitance that provides a capacitive and inductive coupling between said sensor unit and said object.

23. The apparatus of Claim 4, wherein said resonance sensor unit comprises:

a resonance oscillating circuit characterized by inherent inductance, inherent capacitance, and an inherent resonance frequency;

a high-frequency AC generator with an amplitude modulator connected to said sensor means;

an amplifier connected to said sensor means;

a measurement unit connected to said central processing unit;

said resonance oscillating circuit having such a relationship between said inherent inductance and inherent capacitance that provides a capacitive and inductive coupling between said sensor unit and said object.

24. The apparatus of Claim 5, wherein said resonance sensor unit comprises:

a resonance oscillating circuit characterized by inherent inductance, inherent capacitance, and an inherent resonance frequency;

a high-frequency AC generator with an amplitude modulator connected to said sensor means;

an amplifier connected to said sensor means;

a measurement unit connected to said central processing unit;

said resonance oscillating circuit having such a relationship between said inherent inductance and inherent capacitance that provides a capacitive and inductive coupling between said sensor unit and said object.

25. The apparatus of Claim 9, wherein said resonance sensor unit comprises:

a resonance oscillating circuit characterized by inherent inductance, inherent capacitance, and an inherent resonance frequency;

a high-frequency AC generator with an amplitude modulator connected to said sensor means;

an amplifier connected to said sensor means;

a measurement unit connected to said central processing unit;

said resonance oscillating circuit having such a relationship between said inherent inductance and inherent capacitance that provides a capacitive and inductive coupling between said sensor unit and said object.

26. The apparatus of Claim 10, wherein said resonance sensor unit comprises:

a resonance oscillating circuit characterized by inherent inductance, inherent capacitance, and an inherent resonance frequency;

a high-frequency AC generator with an amplitude modulator connected to said sensor means;

an amplifier connected to said sensor means;

a measurement unit connected to said central processing unit;
said resonance oscillating circuit having such a relationship between said inherent inductance and inherent capacitance that provides a capacitive and inductive coupling between said sensor unit and said object.

27. The apparatus of Claim 14, wherein said resonance sensor unit comprises:

a resonance oscillating circuit characterized by inherent inductance, inherent capacitance, and an inherent resonance frequency;

a high-frequency AC generator with an amplitude modulator connected to said sensor means;

an amplifier connected to said sensor means;

a measurement unit connected to said central processing unit;
said resonance oscillating circuit having such a relationship between said inherent inductance and inherent capacitance that provides a capacitive and inductive coupling between said sensor unit and said object.

28. The apparatus of Claim 1, wherein said predetermined initial position is located in said center of rotation of said rotary table.

29. The apparatus of Claim 21, wherein said predetermined initial position is located in said center of rotation of said rotary table.

30. The apparatus of Claim23, wherein said predetermined initial position is located in said center of rotation of said rotary table.

31. The apparatus of Claim 24, wherein said predetermined initial position is located in said center of rotation of said rotary table.

32. The apparatus of Claim 25, wherein said predetermined initial position is located in said center of rotation of said rotary table.

33. The apparatus of Claim 26, wherein said predetermined initial position is located in said center of rotation of said rotary table.

34. The apparatus of Claim 27, wherein said predetermined initial position is located in said center of rotation of said rotary table.

35. The apparatus of Claim 1, further comprising a data storage device connected to said central processing unit.

36. The apparatus of Claim 21, further comprising a data storage device connected to said central processing unit.

37. The apparatus of Claim 22, further comprising a data storage device connected to said central processing unit.

38. The apparatus of Claim 23, further comprising a data storage device connected to said central processing unit.

40. The apparatus of Claim 24, further comprising a data storage device connected to said central processing unit.

41. The apparatus of Claim 25, further comprising a data storage device connected to said central processing unit.

42. The apparatus of Claim 26, further comprising a data storage device connected to said central processing unit.

43. The apparatus of Claim 27, further comprising a data storage device connected to said central processing unit.

44. A method for multiple identical continuous records of characteristics on the surface of an object after selected stages of manufacture and treatment, said method comprising the steps of:

(a) providing an apparatus for multiple identical continuous records of characteristics on the surface of an object after selected stages of manufacture and treatment, said apparatus comprising a rotary table for rotatingly supporting said object, positioning means on said rotary table for installing said object precisely in a predetermined initial position in each installation for starting said identical continuous records from a predetermined starting point after said selected stages of manufacture and treatment, measuring means with a resonance sensor based on resonance sensor technology for measuring characteristics of said object, and recording means for recording the results of measurements;

(b) treating said object on one of said selected stages;

(c) placing said object onto said rotary table of said apparatus upon completion of treatment on said one of said selected stages;

(d) positioning said object in said predetermined initial position;

(e) measuring characteristics of said object with the use of said resonance sensor along a continuous track on said object while rotating said object with a predetermined frequency of rotation and while moving said resonance sensor linearly across said object with a predetermined linear speed which is strictly correlated with said frequency of rotation; and

(f) recording characteristics of said object measured with said resonance sensor;

(g) treating said object on another of said selected stages; and

(h) repeating said steps from (c) to (f).

45. The method of Claim 44, wherein said steps (c) to (f) are repeated after all of said selected stages.

46. The method of Claim 44, wherein said object is a semiconductor water having a center and a periphery, said rotary table having a center of rotation, said method comprising the steps of:

placing said semiconductor wafer in a position on said rotary table in which said center of rotation of said table coincides with said center of said semiconductor wafer;

selecting said predetermined starting point in said center of rotation; and

measuring characteristics of said object while moving said resonance sensor and rotating said rotary table with said semiconductor wafer so that said continuous track comprises a spiral curve started in said center of rotation and developed radially outwardly towards said periphery of said semiconductor wafer.

47. The method of Claim 45, further comprising the step of correlating said linear speed of said resonance sensor with rotation of said rotary table with said semiconductor wafer according to a predetermined law; and observing said law in measuring characteristics of said object after each of said selected stages.